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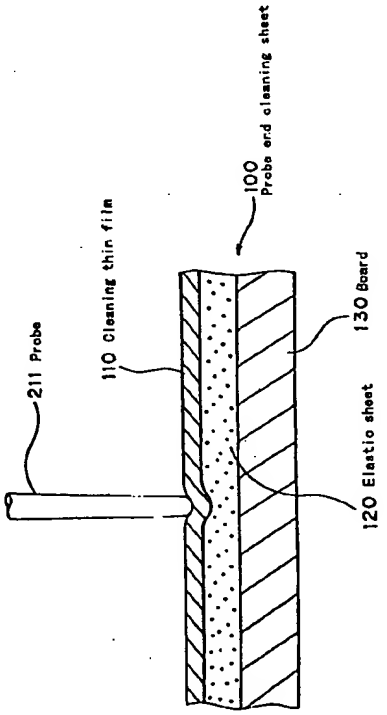
(54) Probe end cleaning sheet

(57) To remove foreign matter without deforming the end of a probe 211, and prevent new foreign matter from adhering to the end of a probe, there is provided a probe end cleaning sheet comprising a cleaning thin film 110 having fine abrasive powder applied on the surface, an elastic sheet 120 provided in a lower layer of the cleaning thin film 110 and having an elasticity, and a board 130 provided in a lower layer of the elastic sheet 120, in which the cleaning thin film 110 is made of a material which is dented when the end of the probe 211 is pressed with a specified load but is not torn by the end of the probe 211, and the elastic sheet 120 is made of a material which is dented in the pressed portion by the end of the probe 211 when the end of the probe 211 is pressed to the cleaning thin film 110 with the specified load.

Fig. 1



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Description

Technical Field of the Invention

[0001] The invention relates to a probe end cleaning sheet for removing foreign matter adhered to the end of a probe.

Prior Art

[0002] The probe of a probe card for measuring various electric properties of semiconductor chips formed on a semiconductor wafer is pressed tight (overdriven) against the pad of semiconductor chips. As a result, foreign matter such as powder of aluminum scraped off from the pad is adhered. This foreign matter is particularly likely to be adhered to the end of the probe when the pad is composed of an alloy of aluminum and copper. Unless such foreign matter is removed from the end of the probe, faulty conduction occurs between the probe and the pad, and electric contact is worsened, and accurate characteristics cannot be measured. If the probe is left over for a long period, the contact resistance tends to be higher.

[0003] To solve such problems, hitherto, the foreign matter is removed by cleaning the end of the probe after every specified number of times of probing.

[0004] For such cleaning, a method of using a ceramic plate, and a method of using a probe end cleaning member for poking the end of the probe are known.

[0005] In the former method, that is, in the method of using a ceramic plate, a ceramic plate in an identical shape with the semiconductor wafer is used. That is, the end of the probe is overdriven against the ceramic plate same as in the case of probing, and aluminum powder or other foreign matter is removed from the end of the probe.

[0006] In the latter method, that is, in the method of using a probe end cleaning member, the end of the probe is cleaned by poking the end of the probe through the probe end cleaning member.

[0007] However, the former method, that is, cleaning of probe by using the ceramic plate had the following problems.

[0008] That is, after plural times of cleaning, the end of the probe is scraped off. The end of the probe is generally formed in a spherical form so as to contact smoothly with the pad, but this end is polished by the ceramic plate, and finally becomes flat. The probe with a flat end cannot contact smoothly with the pad, and the contact resistance changes, and the pad is worn out. The probe with a flat end cannot be repaired by the user, or the semiconductor device manufacturer, but can be repaired only by the probe card maker. Therefore, the user must either discard the probe with a flat end or request repair to the probe card maker.

[0009] In the latter method, that is, in the method of using the probe end cleaning member, although it is possible to clean while maintaining the shape, that is, the spherical form of the end of the probe, the base material of the probe end cleaning member, for example, silicone rubber or urethane rubber may be adhered to the end of the probe. In other words, the foreign matter adhered from the pad can be removed by cleaning, but a new foreign matter may be adhered to the end of the probe. Besides, inside of the probe end cleaning member, foreign matter such as aluminum powder removed from the end of the probe is left over, and the capability of removing the foreign matter is lowered, and therefore cleaning cannot be done at the same position every time. Accordingly, it is required to change the position of the probe end cleaning member on every occasion of cleaning.

SUMMARY OF THE INVENTION

[0010] The invention is devised in the light of the above background, and it is hence an object thereof to present a probe end cleaning sheet capable of removing foreign matter without deforming the end of the probe, without allowing new foreign matter to adhere to the end of the probe.

[0011] The probe end cleaning sheet of the invention is a probe end cleaning sheet for removing foreign matter adhered to the end of a probe, comprising a thin film for cleaning having fine abrasive powder applied on the surface or a metal thin film for cleaning made of a metal having a hardness nearly same as or larger than that of the material for composing the probe, having a rough surface, an elastic sheet provided in a lower layer of this thin film for cleaning of metal thin film for cleaning and having an elasticity, and a board provided in a lower layer of this elastic sheet.

[0012] The thin film for cleaning or the metal thin film for cleaning is made of a material which is dented when the end of the probe is pressed with a specified load but is not torn by the end of the probe, and the elastic sheet is made of a material which is dented in the pressed portion by the end of the probe when the end of the probe is pressed to the thin film for cleaning or the metal thin film for cleaning with the specified load.

Brief Description of the Drawings

[0013]

Fig. 1 is a schematic explanatory diagram of cleaning of a probe using a probe end cleaning sheet according to an embodiment of the invention;

Fig. 2 is a drawing of the probe end cleaning sheet in the embodiment of the invention, (A) being a schematic magnified sectional view, (B) being a schematic plan view;

Fig. 3 is a schematic structural view for explaining cleaning of the probe using the probe end cleaning sheet in the embodiment of the invention;

Fig. 4 is a drawing of a probe end cleaning sheet in

other embodiment of the invention, (A) being a schematic magnified sectional view, (B) being a schematic plan view;

Fig. 5 is a schematic structural view for explaining cleaning of the probe using the probe end cleaning sheet in the embodiment of the invention; and

Fig. 6 is a schematic explanatory diagram showing the shape of the end of the probe cleaned by the probe end cleaning sheet in the embodiment of the invention.

[0014] In the drawings, meanwhile, the ratio of dimensions of the parts is determined for the convenience of drafting, and is completely different from the actual ratio of dimensions.

Description of Preferred Embodiments

[0015] A probe end cleaning sheet 100 in an embodiment of the invention is, as shown in fig. 1, a probe end cleaning sheet for removing foreign matter adhered to the end of a probe 211, comprising a cleaning thin film 110 having fine abrasive powder 111 applied on the surface, an elastic sheet 120 provided in a lower layer of this cleaning thin film 110 and having an elasticity, and a board 130 provided in the lower layer of this elastic sheet 120.

[0016] The cleaning thin film 110 is composed by, as shown in Fig. 2, applying the fine abrasive powder 111 on the surface of a thin film 112 with adhesive or the like.

[0017] As the fine abrasive powder 111, alumina powder, silicon carbide powder, diamond powder or the like may be used, and the material and size are properly determined depending on the material and size of the probe 211.

[0018] An important point for the cleaning thin film 110 is that it should have a sufficient rigidity so that the end may not penetrate through the cleaning thin film 110 when the probe 211 is pressed against with a specified load. This is also delicately related with the characteristic of the elastic sheet 120 described below, and if the end of the probe 211 penetrates through the cleaning thin film 110, the end of the probe 211 reaches up to the elastic sheet 120 provided in the lower layer of the cleaning thin film 110, and therefore, as in the case of the conventional probe end cleaning member, a new foreign matter may be adhered to the end of the probe 211.

[0019] The thickness dimension of this cleaning thin film 110 is preferred to be, for example, 100 micrometers or less.

[0020] On the other hand, the elastic sheet 120 is made of silicone rubber or urethane rubber having a uniform thickness dimension. Herein, the reason of setting the elastic sheet 120 in a uniform thickness dimension is explained below. That is, if the elastic sheet 120 is not uniform in thickness dimension, when cleaning the probe 211, the end of the probe 211 contacts with the probe end cleaning sheet 100 irregularly, and in the cleaning process, an excessive load is applied to the probe 211 coming into contact in the first place. Therefore, the thickness dimension of the elastic sheet 120 is preferred to be 1 millimeter or less.

[0021] The required hardness of the elastic sheet 120 is delicately related with the characteristics of the cleaning thin film 110 as mentioned above, and preferably the hardness should be such that it may be dented by a load of several grams to scores of grams per one probe 211.

[0022] That is, the elastic sheet 120 is made of material having such a hardness as to be in the pressing portion by the end of the probe 211 when the end of the probe 211 is pressed to the cleaning thin film with a specified load. For example, as mentioned above, silicone rubber or urethane rubber may be used as the elastic sheet 120.

[0023] Moreover, when the elastic sheet 120 is formed of silicone rubber or urethane rubber, it is an advantage that it is not necessary to glue the cleaning thin film 110 with adhesive or the like. That is, only by putting the cleaning thin film 110 tightly on the elastic sheet 120 made of silicone rubber or urethane rubber, the cleaning thin film 110 is sucked and fixed to the elastic sheet 120, and its setting is easy. If the cleaning thin sheet 110 is glued to the elastic sheet 120 with adhesive or the like, if the adhesive is applied unevenly, in spite of uniform thickness dimension of the elastic sheet 120, undulations are formed on the cleaning thin film 110 due to uneven application, and correct cleaning is impaired, but such problem does not occur because adhesive is not used.

[0024] The specified load for pressing the probe 211 is several grams to scores of grams per one probe 211, and when the cleaning thin film 110 is made of silicon carbide, the elastic sheet 120 is silicone rubber, and the probe 211 is tungsten, it is preferably about 3 to 10 grams.

[0025] On the other hand, the board 130 is made of, for example, metal plate, ceramic plate, or silicone wafer. The board 130 is required to have enough rigidity to be free from effects of deformation of the elastic sheet 120, that is, the dent when the end of the probe 211 is pressed.

[0026] The probe end cleaning sheet 110 thus composed by laminating the cleaning thin film 110, elastic sheet 120, and board 130 sequentially from the upper layer side is formed in the same size and shape as the semiconductor wafer on which the semiconductor chip to be measured by the prober is formed. Therefore, the thickness dimension of the probe end cleaning sheet 100 is set at about 0.8 to 2.0 millimeters.

[0027] Herein, the following benefits are produced when the probe end cleaning sheet 100 is in the same size and shape as the semiconductor wafer forming the semiconductor chip thereon to be measured.

[0028] First, the semiconductor wafer forming the semiconductor chip to be measured is set in the prober, having a plurality held in one cassette, and each piece

is taken out of the cassette, and electric characteristics are measured, and, by mixing probe end cleaning sheets 100 at a specified rate, for example, one probe end cleaning sheet 100 for every 20 semiconductor wafers, the probe 211 can be cleaned automatically. In this case, however, when the probe end cleaning sheet 100 is taken out, different from ordinary measurement, it is necessary to move up and down the probe 211 plural times, but it is possible to enter preliminarily the sequence of taking out the probe end cleaning sheet 100, or to move the probe 211 up and down only in the case of probe end cleaning sheet 100 by detecting the probe end cleaning sheet 100 by some means.

[0029] By thus constituted probe end cleaning sheet 100, cleaning of the probe 211 is described below.

[0030] Preliminarily, a prober 200 using the probe 211 to be cleaned by the probe end cleaning sheet 100 is described.

[0031] As shown in Fig. 3, the prober 200 is roughly divided into a probe card 210, a base 220 to which the probe card 210 is attached, and a suction table 230 for fixing the semiconductor wafer forming the semiconductor chip to be measured.

[0032] The probe card 210 includes a plurality of probes 211 disposed corresponding to the configuration of pads of semiconductor chips, a board 212 on which the probes 211 are mounted, and a probe support 213 mounted on the board 212 for supporting the probes 211. In this probe card 210, the probes 211 are mounted vertically on the board 212, and the ends of the probes 211 contact with the pads vertically, and hence it is called the probe card of vertical operation type. In the probe 211, meanwhile, a nearly lateral U-shaped curvature 211A is formed in order to keep a specified contact pressure between the pads and probes 211 by deforming when the ends are pressed against the pads. The end of the probe 211 is formed in a spherical shape as shown in Fig. 6 (A). The probe 211 is made of tungsten.

[0033] In the board 212 of the probe card 210, a wiring pattern 212A connected to the probe 211 is formed, and the probe 211 is connected to the tester not shown in the drawing through this wiring pattern 212A.

[0034] The probe support 213 is intended to prevent contact with an adjacent probe 211 when the probe 211 is pressed against the pad, and each probe 211 is inserted into an independent penetration hole (not shown).

[0035] The suction table 230 provided beneath the probe card 211 is to suck and fix not only the semiconductor wafer forming the semiconductor chip to be measured, but also the probe end cleaning sheet 100.

[0036] By thus constituted prober 200, the end of the probe 211 is cleaned by the probe end cleaning sheet 100 in the following procedure. First, the probe end cleaning sheet 100 is set at a specified position instead of the semiconductor wafer, that is, on the suction table 230 beneath the probe card 210. For this setting, in addition to the above method of mixing the probe end cleaning sheets 100 at a specified rate in the semiconductor wafers, the probe end cleaning sheets 100 may be provided in the prober 200 aside from the semiconductor wafers forming the semiconductor chips to be measured, it may be designed to set the probe end cleaning sheet 100 when measurement of a specified number of semiconductor wafers is over.

[0037] When the probe end cleaning sheet 100 is set on the suction table 230, either one or both of the probe card 210 and the suction table 230 setting the probe end cleaning sheet 100 are moved up and down, and the end of the probe 211 is repeatedly pressed against the surface of the probe end cleaning sheet 100.

[0038] At this time, the load of pushing the probe 211 to the probe end cleaning sheet 100 per probe is selected at a proper value by the material of the cleaning thin film 110, elastic sheet 120 and probe 211.

[0039] In this way, as the end of the probe 211 is pressed against the probe end cleaning sheet 100, as shown in Fig. 1, without tearing the cleaning thin film 110, the state of being wrapped in the cleaning thin film 120 by the dent formed in the elastic sheet 120 is repeated.

[0040] Since the fine abrasive powder 111 is applied to the cleaning thin film 110, the surface is rough, and by this rough surface, the foreign matter adhered to the end of the probe 211 is removed. Further, as the elastic sheet 120 presses the probe 211, it is dented according to the end shape of the probe 211, and therefore if the fine abrasive powder 111 is applied on the surface of the cleaning thin film 110, unlike the conventional ceramic plate, the end of the probe 211 is not scraped off at all.

[0041] When cleaning of the probe 211 is complete, the probe end cleaning sheet 100 is detached from the suction table 230, and a new semiconductor wafer to be measured next is set, and the electric characteristics of the semiconductor chips formed on the new semiconductor wafer are measured in succession.

[0042] In this probe end cleaning sheet 100, the cleaning thin film 110 is formed by applying fine abrasive powder 111 on the thin film 112, but instead, as shown in Fig. 4, a cleaning metal thin film 140 may be used. In this cleaning metal thin film 140, the surface of a metal thin film 141 of, for example, tungsten is roughened by proper means such as sand blasting or etching to for a rough surface 142. It is more effective to treat this surface with rhodium plating or the like.

[0043] The probe end cleaning sheet using such cleaning metal thin film 140 is formed, same as above, by laminating an elastic sheet 120 in the lower layer of the cleaning metal thin film 140 and a board 130 in the lower layer of the elastic sheet 120, and the elastic sheet 120 and board 130 have same characteristics as mentioned above.

[0044] This cleaning metal thin film 140, like the above cleaning thin film 110, is required to have enough rigidity so that the end of the probe 211 may not penetrate through the cleaning metal thin film 140 when the probe

211 is pressed. If the end of the probe 211 penetrates through the cleaning metal thin film 140, the end of the probe 211 reaches up to the elastic sheet 120 provided in the lower layer of the cleaning metal thin film 140, and therefore, as in the case of the conventional probe end cleaning member, a new foreign matter may be adhered to the end of the probe 211.

[0045] The thickness dimension of the cleaning metal tin film 140 is preferred to be 5 micrometers to 50 micrometers when the material of the cleaning metal thin film 140 is tungsten, or 20 micrometers to 100 micrometers in the case of palladium.

[0046] For example, in the case of using the probe end cleaning sheet 100, when the probe 211 of which contact resistance is 10 ohms at the end due to deposit of foreign matter is cleaned about 10 times, by pressing the end of the probe 211 and moving the probe 211 up and down, the contact resistance becomes 0.5 ohm or less, and there is no problem, according to the results of experiments, in measurement of electric characteristics of semiconductor chips formed on the semiconductor wafer.

[0047] The explanation so far relates to the probe card 210 of vertical operation type probe card in which the probe 211 contacts with the pad vertically, but, as shown in Fig. 5, it is similarly applied to the so-called cantilever type probe card in which the end of the probe 211 is folded and inclined to contact with the pad. Moreover, as shown in Fig. 6 (B), (C), in the case of the cantilever type probe card, the probe 211 may also have a flat end.

[Effects of the Invention]

[0048] The probe end cleaning sheet of the invention is a probe end cleaning sheet for removing foreign matter adhered to the end of a probe, which comprises a thin film for cleaning having fine abrasive powder applied on the surface, an elastic sheet provided in a lower layer of this thin film for cleaning and having an elasticity, and a board provided in a lower layer of this elastic sheet, in which the thin film for cleaning is made of a material which is dented when the end of the probe is pressed with a specified load but is not torn by the end of the probe, and the elastic sheet is made of a material which is dented in the pressed portion by the end of the probe when the end of the probe is pressed to the thin film for cleaning with the specified load.

[0049] Therefore, when the probe is pressed against the probe end cleaning sheet, the end of the probe is wrapped in the cleaning thin film, and the foreign matter is removed by the fine abrasive powder applied on the cleaning thin film. At this time, since the cleaning thin film sheet and elastic sheet are dented according to the shape of the end of the probe, the end of the probe is not scraped off as experienced in the conventional ceramic plate. Moreover, since the end of the probe does not penetrate through the cleaning thin film, the material for composing the elastic sheet is not adhered to the end of the probe as a new foreign matter. Still more, the foreign matter can be removed without deforming the end of the probe, and the probe end cleaning sheet free from deposit of new foreign matter on the end of the probe is obtained.

[0050] Other probe end cleaning sheet of the invention is a probe end cleaning sheet for removing foreign matter adhered to the end of a probe, which comprises a metal thin film for cleaning made of a metal having a hardness nearly same as or larger than that of the material for composing the probe, having a rough surface, an elastic sheet provided in a lower layer of this metal thin film for cleaning and having an elasticity, and a board provided in a lower layer of this elastic sheet, in which the metal thin film for cleaning is made of a material which is dented when the end of the probe is pressed with a specified load but is not torn by the end of the probe, and the elastic sheet is made of a material which is dented in the pressed portion by the end of the probe when the end of the probe is pressed to the metal thin film for cleaning with the specified load.

[0051] Also in this probe end cleaning sheet, same as in the above probe end cleaning sheet, when the probe is pressed against the probe end cleaning sheet, the end of the probe is wrapped in the cleaning thin film, and the foreign matter is removed by the fine abrasive powder applied on the cleaning thin film. At this time, since the cleaning thin film sheet and elastic sheet are dented according to the shape of the end of the probe, the end of the probe is not scraped off as experienced in the conventional ceramic plate. Moreover, since the end of the probe does not penetrate through the cleaning thin film, the material for composing the elastic sheet is not adhered to the end of the probe as a new foreign matter. Still more, the foreign matter can be removed without deforming the end of the probe, and the probe end cleaning sheet free from deposit of new foreign matter on the end of the probe is obtained.

[0052] The specified load ranges from several grams (eg 3 gm) to scores of grams (eg 80 gm), and a proper value may be selected depending on the material of the cleaning thin film, cleaning metal thin film, elastic sheet and probe.

Claims

1. A probe end cleaning sheet, being a probe end cleaning sheet for removing foreign matter adhered to the end of a probe, comprising a thin film for cleaning having fine abrasive powder applied on the surface, an elastic sheet provided in a lower layer of this thin film for cleaning and having an elasticity, and a board provided in a lower layer of this elastic sheet, wherein said thin film for cleaning is made of a material which is dented when the end of the probe is pressed with a specified load but is not torn by the end of the probe, and the elastic sheet is

made of a material which is dented in the pressed portion by the end of the probe when the end of the probe is pressed to the thin film for cleaning with said specified load.

2. A probe end cleaning sheet, being a probe end cleaning sheet for removing foreign matter adhered to the end of a probe, comprising a metal thin film for cleaning made of a metal having a hardness nearly same as or larger than that of the material for composing the probe, having a rough surface, an elastic sheet provided in a lower layer of this metal thin film for cleaning and having an elasticity, and a board provided in a lower layer of this elastic sheet, wherein said metal thin film for cleaning is made of a material which is dented when the end of the probe is pressed with a specified load but is not torn by the end of the probe, and the elastic sheet is made of a material which is dented in the pressed portion by the end of the probe when the end of the probe is pressed to the metal thin film for cleaning with said specified load.

3. A probe end cleaning sheet of claim 1 or 2, wherein said specified load ranges from several grams to scores of grams.

Fig. 1

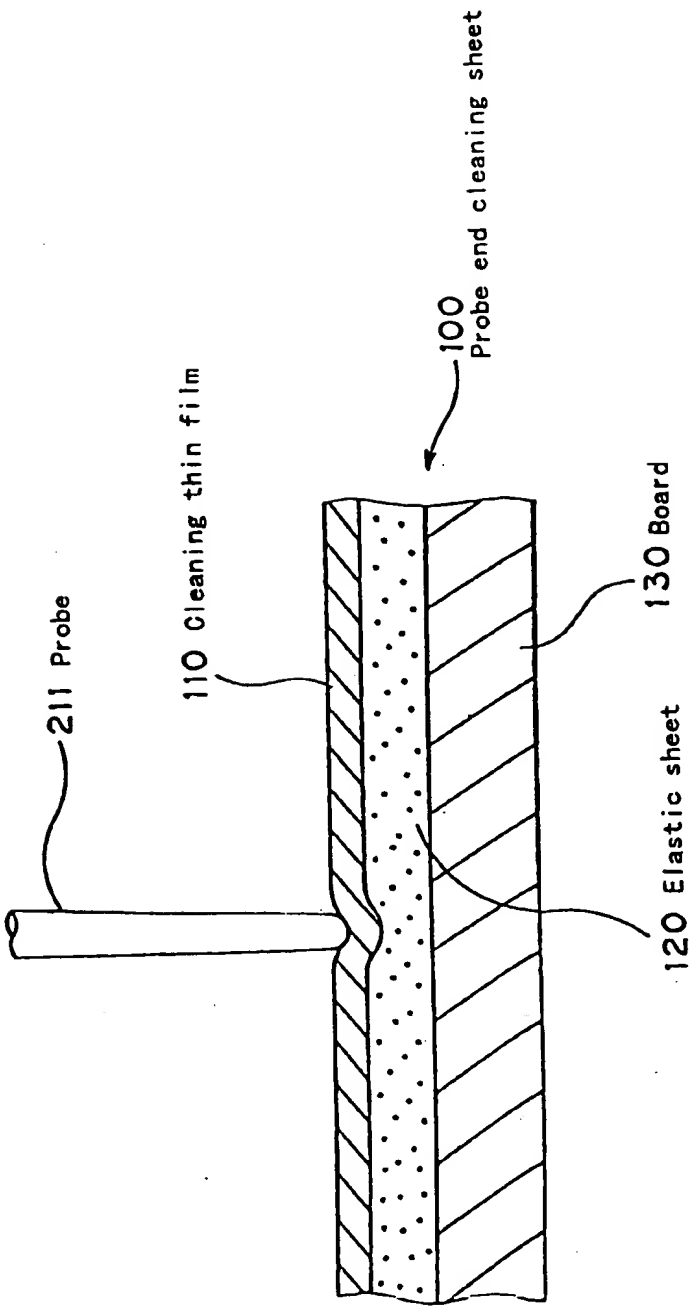
100
Probe end cleaning sheet
110 Cleaning thin film
211 Probe
130 Board
120 Elastic sheet

Fig. 2

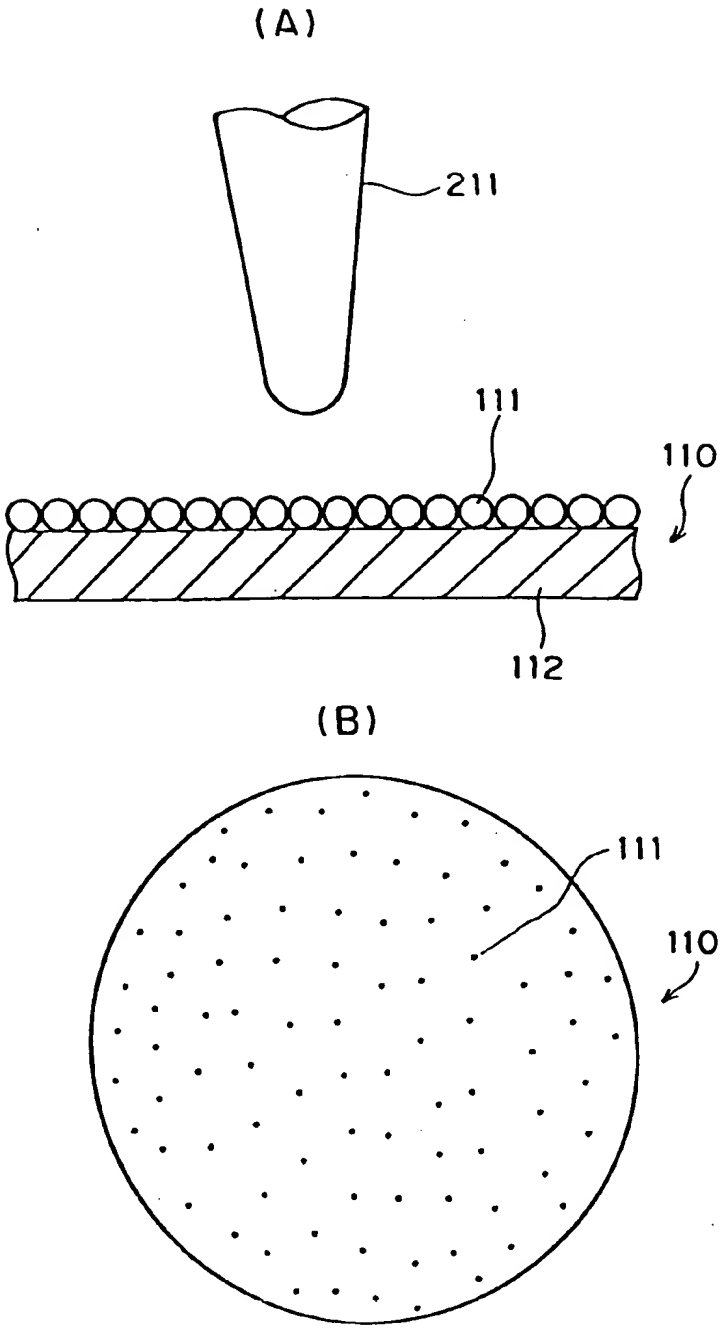

Fig. 3

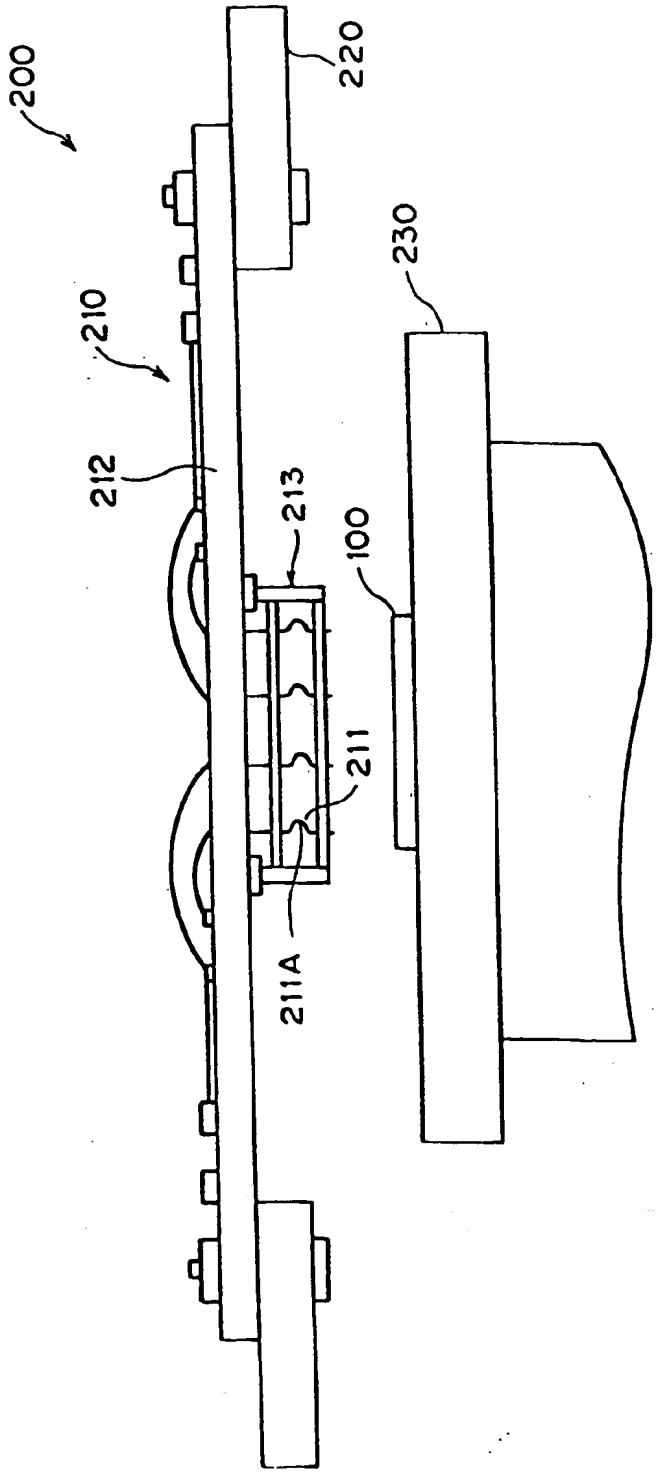

Fig. 4

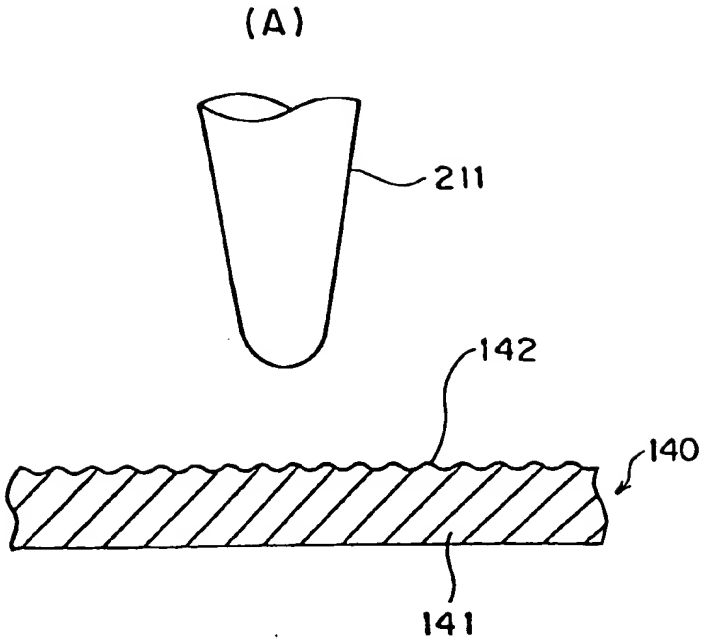

Fig. 5

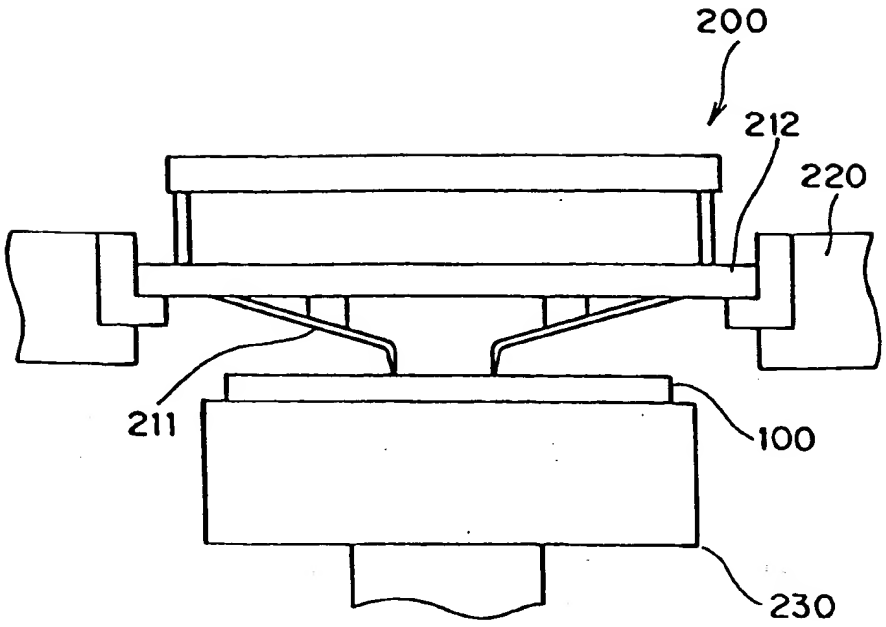

Fig. 6